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A Check-List of the Fishes of Southern California and Lower California

By ALBERT B. ULREY
Professor of Zoology, University of Southern California

This Check-List includes the fresh-water and marine fishes recorded from the streams and off shores of southern California and Lower California.

The area included in this region extends from Point Conception on the north to Cape San Lucas on the south and includes the Channel Islands on the west.

Some data concerning the distribution of the species are indicated by the following symbols placed after the authority for the species: *, Lower California; †, Cape San Lucas; ‡, Gulf of Lower California; arabic numerals, number in "List of Marine fishes (Teleostei) of southern California with their Distribution" by Albert B. Ulrey and Paul O. Greeley, Bull. So. Calif. Acad. Sci., xxviii, Jan.-Apr. 1928, No. 1; SC. Southern California (chiefly exclusive of Teleostei).

The abbreviation Fr. indicates fresh-water forms and In. introduced species.

The author is indebted to several friends who have rendered valuable assistance in the preparation of the check-list. Among these should be mentioned Chancellor Emeritus David Starr Jordan, Stanford University, Dr. Barton Warren Evermann, Director, Museum California Academy of Sciences, and Dr. Carl L. Hubbs, Museum of Zoology, University of Michigan.

Family I.
BRANCHIOSTOMIDÆ. The Lancelets.
1. Branchiostoma californiense Gill. SC. † ‡

Family II
EPTATRETIDÆ.
2. Polistotrema stoutii Lockington. SC.
3. Polistotrema deani Evermann & Goldsborough. SC.

Family III
PETROMYZONIDÆ. The Lampreys.
4. Entosphenus tridentatus Gairdner. SC.

Family IV.
HETERODONTIDÆ. The Bullhead Sharks.
5. Heterodontus francisci Girard. SC. * ‡

Family V
HEXANCHIDÆ. The Cow Sharks.
6. Notorhynchus maculatus Ayres. SC.

Family VI
SCYLLIORHINIDÆ. The Cat Sharks.
7. Parmaturus xaniurus Gilbert. SC. *
8. Apristurus brunneus Gilbert. ‡
9. Scylliorhinus cephalus Gilbert. * ‡
10. Cephaloscyllium uter Jordan & Gilbert. SC.

Family VII.
RHINEODONTIDÆ.
11. Rhineodon typicus Smith.

Family VIII.
LAMNIDÆ. The Mackerel Sharks: Man-Eaters.
12. Carcharodon carcharias Linnæus. SC. Henle. SC.

Family IX.
ALOPIDÆ. The Thresher Sharks.
13. Alopius vulpinus Bonnaterre. SC.

Family X.
CETORHINIDÆ. The Basking Sharks.
14. Cetorhinus maximus Gunner. SC.

Family XI.
CARCHARIIDÆ. The Gray Sharks.
15. Carcharhias æthalorus Jordan & Gilbert. ‡
16. Carcharhias lamiella Jordan & Gilbert. SC. *
17. Cynias lunulatus Jordan & Gilbert. SC. *
18. Mustelus californicus Gill. SC.
19. Mustelus dorsalis Gill. ‡
20. Rhinotriacis henlei Gill. SC.
21. Triakis semifasciatum Girard. SC.
22. Galeorhinus zyopterus Jordan & Gilbert SC.
23. Galeocerdo tigrinus Müller & Henle. SC. *
24. Prionace glauca Linnæus. SC. ‡

Family XII.
SPHYRNIDÆ. The Hammerhead Sharks.
25. Sphyrna zygæna Linnæus. SC.
26. Platysqualus tudes Cuvier. ‡

Family XIII.
SQUALIDÆ. The Dog-fishes.
27. Squalus suckleyi Girard. SC.

Family XIV.
SQUATINIDÆ. The Angel Sharks.
28. Squatina californica Ayres. SC.

Family XV.

RHINOBATIDÆ.

29. Rhinobatos productus Ayres. SC. *
30. Rhinobatos glaucostigma Jordan & Gilbert. ‡
31. Zapteryx exasperatus Jordan & Gilbert. SC.

Family XVI.

PLATYRHINIDÆ.

32. Platyrhinoidis triseriatus Jordan & Gilbert. SC.

Family XVII.

RAJIDÆ. Rays: Skates.

33. Raja rhina Jordan & Gilbert. SC.
34. Raja binoculata Girard. SC.
35. Raja inornata Jordan & Gilbert. SC.
36. Raja montereyensis Gilbert. SC.
37. Raja stellulata Jordan & Gilbert. SC.
38. Raja trachura Gilbert. SC.
39. Raja microtrachys Osburn & Nichols. *

Family XVIII.

TORPEDINIDÆ.

The Torpedos; Numb-fishes.

40. Tetronarce californica Ayres. SC.
41. Narcine entemador Jordan & Starks. ‡
42. Discopyge ommata Jordan & Gilbert. ‡

Family XIX.

DASYATIDÆ.

43. Urotrygon mundus Gill. *
44. Urotrygon binghami Breder. ‡
45. Urobatis halleri Cooper. SC. ‡
46. Urobatis nebulosus Garman. ‡
47. Urobatis concentricus Osburn & Nichols. ‡
48. Urobatis marmoratus Garman. ‡
49. Dasyatis dipterura Jordan & Gilbert. SC.
50. Pteroplatea cerebripunctata Peters. ‡
51. Pteroplatea marmorata Cooper. SC. *

Family XX.

MYLIOBATIDÆ.

52. Myliobatis californica Gill. SC. *
53. Aëtobatus narinari Euphrasen. ‡
54. Rhinoptera steindachneri Evermann & Jenkins. ‡
55. Rhinoptera encenadæ Rosa Smith (Mrs. Eigenmann.)

Family XXI.

MOBULIDÆ.

56. Manta birostris Walbaum. SC.

Family XXII.

CHIMÆRIDÆ.

57. Hydrolagus colliei Lay & Bennett. SC.

Family XXIII.

RHINOCHIMÆRIDÆ.

58. Harriotta curtiss-jamesi Townsend & Nichols. *

Family XXIV.

ALBULIDÆ. The Lady-fishes.

59. Albula vulpes Linnæus. 10 ‡

Family XXV.

CHANIDÆ

60. Chanos chanos Forskål. ‡

Family XXVI.

CLUPEIDÆ. The Herrings.

61. Clupea pallasii Cuvier & Valenciennes 55.
62. Sardinops cærulea Girard 57. * † ‡
63. Alosa sapidissima Wilson 54. In.
64. Harengula thrissina Jordan & Gilbert. ‡
65. Lile stolifera Jordan & Gilbert. ‡
66. Opisthonema libertate Günther. * ‡

Family XXVII.

DUSSUMIERIIDÆ. The Round Herrings.

67. Jenkinsia acuminata Gilbert. ‡
68. Etrumeus micropus Temminck & Schlegel. SC.

Family XXVIII

ENGRAULIDÆ. The Anchovies.

69. Anchoviella ischanus Jordan & Gilbert. ‡
70. Anchoviella cultrata Gilbert. *
71. Anchoviella delicatissima Girard 108.
72. Anchoviella helleri Hubbs. ‡
73. Anchoviella compressa Girard 107. * ‡
74. Anchoviella mundeoloides Breder. ‡
75. Cetengraulis mysticetus Günther. ‡
76. Engraulis mordax Girard 109. *

Family XXIX.

ALEPOCEPHALIDÆ.

77. Alepocephalus tenebrosus Gilbert 11. *
78. Bajacalifornia burragei Townsend & Nichols. *
79. Xenognathus profundorum Gilbert 12.
80. Narcetes stomias Gilbert. *

Family XXX.

SALMONIDÆ. The Salmon: Trout.

81. Salmo nelsoni Evermann. * Fr.
82. Salmo irideus Gibbons. SC. Fr.
83. Salmo evermanni Jordan & Grinnell. SC. Fr.
84. Salmo henshawi Gill & Jordan. Fr.
85. Salmo pleuriticus Cope. SC. Fr.
86. Salvelinus fontinalis Mitchill. SC. In. Fr.
87. Oncorhynchus tschawytscha Walbaum. SC. Fr.

Family XXXI.

ARGENTINIDÆ. The Smelts.

88. Argentina sialis Gilbert 16.
89. Leuroglossus stilbius Gilbert 16a.

Family XXXII.

STOMIATIDÆ.

90. Zastomias scintillans Gilbert 276.

Family XXXIII.

STYLOPHTHALMIDÆ.

91. Stylophthalmus paradoxus Brauer 278.

Family XXXIV.

CHAULIODONTIDÆ.

92. Cyclothone acclividens Garman. SC. *
93. Chauliodus macouni Bean 53.

Family XXXV.

STERNOPTYCHIDÆ.

94. Argyropelecus lichnus Garman. †
95. Argyropelecus affinis Garman. *

Family XXXVI.
IDIACANTHIDÆ.
96. Idiacanthus anostromus Gilbert 136.

Family XXXVII.
HALOSAURIDÆ.
97. Halosaurus attenuatus Garman. *

Family XXXVIII.
MURÆNESOCIDÆ.
98. Muræsox coniceps Jordan & Gilbert. †

Family XXXIX.
CONGRIDÆ.
99. Ariosoma gilberti Ogilby.
100. Anago macrurus Gilbert.[1] ‡
101. Neoconger vermiformis Gilbert. *

Family XL.
NETTASTOMIDÆ. The Duck-bill Eels.
102. Chlopsis gilberti Garman 175.
103. Venefica procera Goode & Bean 175a.
104. Venefica tentaculata Garman 176. *

Family XLI.
ECHELIDÆ. The Myridæ.
105. Myrophis vafer Jordan & Gilbert. ‡

Family XLII.
NEMICHTHYIDÆ. The Thread Eels.
106. Serrivomer sector Garman. * ‡
107. Nemichthys fronto Garman. *

Family XLIII.
CYEMIDÆ.
108. Cyema atrum Günther. *

Family XLIV.
MYRIDÆ.
109. Myrophis vafer Jordan & Gilbert. ‡

Family XLV.
OPHICHTHYIDÆ. The Snake Eels.
110. Letharchus pacificus Osburn & Nichols.
111. Sphagebranchus selachops Jordan & Gilbert. †
112. Myrichthys tigrinus Girard. ‡
113. Bascanichthys peninsulae Gilbert. ‡
114. Bascanichthys bascanoides Osburn & Nichols.
115. Bascanichthys panamensis Meek & Hildebrand.
116. Quassiremus notochir Gilbert. ‡
117. Ophichthus triseralis Kaup 177. ‡
118. Ophichthus zophochir Jordan & Gilbert 178. ‡
119. Scytalichthys miurus Jordan & Gilbert. †

Family XLVI.
MURÆIDÆ. The Morays.
120. Gymnothorax mordax Ayres 163.
121. Gymnothorax funebris Ranzani. ‡
122. Gymnothorax dovii Günther. ‡
123. Gymnothorax caudilimbatus Poeyu. ‡
124. Muræna lentiginosa Jenyns. ‡
125. Echidna nocturna Cope. ‡
126. Uropterygius necturus Jordan & Gilbert. ‡

Family XLVII.
CATOSTOMIDÆ. Suckers; Buffalo Fishes.
127. Notolepidomyzon santa-anæ Snyder. SC. Fr.
128. Xyrauchen texanus Abbott. SC. * Fr.

Family XLVIII.
CYPRINIDÆ. Carps; Minnows, etc.
129. Cyprinus carpio Linnæus. SC. Fr.
130. Tigoma orcutti Eigenmann & Eigenmann.
131. Gila elegans Baird & Girard. SC. * Fr.
132. Ptychocheilus lucius Girard. SC. * Fr.
133. Apocope oscula Girard subsp.
134. Siphateles mohavensis Snyder. SC. Fr.

Family XLIX.
ARIIDÆ. The Sea Cat-fishes.
135. Netuma platypogon Günther. ‡
136. Arius melanopus Günther. *

Family L.
SYNODONTIDÆ. The Lizard Fishes.
137. Synodus lacertinus Gilbert. †
138. Synodus scituliceps Jordan & Gilbert. †
139. Synodus jenkinsi Jordan & Bollman. ‡
140. Synodus lucioceps Ayres 286.
141. Bathysaurus mollis Günther. *

Family LI.
PARALEPIDÆ.
142. Sudis ringens Jordan & Gilbert 182.
143. Lestidiops sphyrænopsis Hubbs 181.

Family LII.
MYCTOPHIDÆ. The Lantern Fishes.
144. Scopelengys dispar Garman. *
145. Macrostoma angustidens Risso 168.
146. Lampanyctus townsendi Eigenmann & Eigenmann 172.
147. Lampanyctus regalis Gilbert 166.
148. Lampanyctus ritteri Gilbert 167.
149. Nannobrachium leucopsarum Eigenmann & Eigenmann 171.
150. Nannobrachium nannochir Gilbert. SC.
151 Nannobrachium mexicanum Gilbert. *
152. Nannobrachium regale Gilbert. SC.
153. Diaphus theta Eigenmann & Eigenmann 165.
154. Myctophum affine Lütken 169.
155. Myctophum californiense Eigenmann & Eigenmann 170.
156. Tarletonbeania crenularis Jordan & Gilbert 173.
157. Tarletonbeania tenua Eigenmann & Eigenmann 174.

Family LIII.
CYPRINODONTIDÆ. The Killifishes.
158. Fundulus vinctus Jordan and Gilbert. *
159. Fundulus parvipinnis Girard 200. *
160. Fundulus lima Vaillant. *
161. Fundulus extensus Jordan & Gilbert. †
162. Cyprinondon macularius Baird & Girard. SC. * Fr.
163. Cyprinodon californiensis Girard=*Lucania, browni* Jordan & Richardson. Fr.

Family LIV.

EMPETRICHTHYIDÆ.

164. Empetrichthys merriami Gilbert. SC. Fr.

Family LV.

CHARACODONTIDÆ.

165. Characodon furcidens Jordan & Gilbert. †

Family LVI.

BELONIDÆ. The Needle-fishes.

166. Strongylura stolzmanni Steindachner. ‡
167. Strongylura exilis Girard 26. ‡
168. Strongylura petrura Osburn & Nichols. ‡
169. Tyleosurus fodiator Jordan & Gilbert. †

Family LVII.

SCOMBRESOCIDÆ. The Sauries.

170. Cololabis saira Brevoort 216.

Family LVIII.

HEMIRAMPHIDÆ. The Half-beaks.

171. Hyporhamphus rosæ Jordan & Gilbert 132. ‡
172. Hyporhamphus unifasciatus Ranzani. †
173. Hemirhamphus balao Le Sueur. ‡

Family LIX

EXOCŒTIDÆ. The Flying-Fishes.

174. Fodiator acutus Cuvier & Valenciennes. * ‡
175. Cypselurus californicus Cooper 111.
176. Exonautes rondelettii Cuvier & Valenciennes 112.

Family LX.

CORYPHÆNOIDIDÆ. The Grenadiers: Rat-tails.

177. Coryphænoides acrolepis Bean 156. *
178. Coryphænoides abyssorum Gilbert 158.
179. Coryphænoides albatrossus Townsend & Nichols. *
180. Lionurus stelgidolepis Gilbert 157. *
181. Lionurus liolepis Gilbert 155. * †
182. Cælorhynchus scaphopsis Gilbert. SC.

Family LXI.

GADIDÆ. The Cod-Fishes.

183. Physiculus nematopus Gilbert 113.
184. Physiculus rastrelliger Gilbert. SC.
185. Antimora microlepis Bean. SC. *

Family LXII.

MERLUCIIDÆ. The Hakes.

186. Merluccius productus Ayres 160. †

Family LXIII.

LOPHOTIDÆ.

187. Lophotes cepedianus Giorna 150.

Family LXIV.

REGALECIDÆ. The Oar-Fishes: Sea-Serpents.

188. Regalecus russelli Shaw 205.

Family LXV.

TRACHIPTERIDÆ. The King-of-the-Herrings.

189. Trachypterus rex-salmonorum Jordan & Gilbert 289.

Family LXVI.

LAMPRIDÆ. The Opah: Moon-fish.

190. Lampris regius Bonnaterre 143.

Family LXVII.

BOTHIDÆ.

191. Platophrys leopardinus Günther. † ‡
192. Perissias tæniopterus Gilbert. * ‡
193. Syacium ovale Günther. ‡
194. Orthopsetta sordida Girard 190. *
195. Orthopsetta fragilis Gilbert. ‡
196. Orthopsetta xanthostigma Gilbert 192. * ‡
197. Orthopsetta stigmæa Jordan & Gilbert 191.
198. Citharichthys gilberti Jenkins & Evermann. †
199. Etropus crossotus Jordan & Gilbert. *

Family LXVIII.

PARALICHTHYIDÆ. The Bastard Halibuts.

200. Hippoglossina stomata Eigenmann & Eigenmann 185.
201. Hippoglossina macrops Steindachner. *
202. Lioglossina tetrophthalma Gilbert. ‡
203. Xystreurys liolepis Jordan & Gilbert 199.
204. Paralichthys maculosus Girard 193. *
205. Paralichthys æstuarius Gilbert & Scofield. ‡
206. Paralichthys magdalenæ Abbott. *
207. Paralichthys adspersus Steindachner. ‡
208. Ramularia dendritica Gilbert. ‡

Family LXIX.

HIPPOGLOSSIDÆ. The Halibuts.

209. Lyopsetta exilis Jordan & Gilbert 188.
210. Eopsetta jordani Lockington 183.

Family LXX.

PLEURONECTIDÆ.

211. Pleuronichthys decurrens Jordan & Gilbert 196.
212. Pleuronichthys ritteri Starks & Morris 197.
213. Pleuronichthys ocellatus Starks & Thompson. ‡
214. Pleuronichthys verticalis Jordan & Gilbert 198. *
215. Pleuronichthys cœnosus Girard 195.
216. Hypsopsetta guttulata Girard 186. * ‡
217. Parophrys vetulus Girard 194.
218. Lepidopsetta bilineata Ayres 187.
219. Embassichthys bathybius Gilbert SC.
220. Microstomus pacificus Lockington 189.
221. Errex zachirus Lockington 184.

Family LXXI.

CYNOGLOSSIDÆ. The Tongue-Fishes.

222. Symphurus fasciolaris Gilbert. * ‡
223. Symphurus atricaudus Jordan & Gilbert 274. * †
224. Symphurus williamsi Jordan & Culver. †

Family LXXII.

MELAMPHAËDÆ.

225. Melamphaës maxillaris Garman. SC.
226. Melamphaës cristiceps Gilbert 28. *
227. Melamphaës bispinosus Gilbert 27.
228. Melamphaës nycterinus Gilbert 29.
229. Melamphaës lugubris Gilbert. †

Family LXXIII.

HOLOCENTRIDÆ. The Soldier-Fishes.

230. Myripristis pœcilopus Gill. †
231. Holocentrus suborbitalis Gill. ‡

Family LXXIV.

GASTEROSTEIDÆ. The Sticklebacks.

232. Gasterosteus aculeatus microcephalus. Girard. SC. Fr. *
233. Gasterosteus aculeatus williamsoni Girard. SC. Fr.

Family LXXV.

AULORHYNCHIDÆ.

234. Aulorhynchus flavidus Gill 21.

Family LXXVI.

SYNGNATHIDÆ. The Pipe-Fishes: Sea-Horses.

235. Syngnathus carinatus Gilbert. ‡
236. Syngnathus californiensis Storer 283.
237. Syngnathus exilis Osburn & Nichols.
238. Syngnathus leptorhynchus Girard 284.
239. Syngnathus auliscus Swain 281. *
240. Syngnathus arctus Jenkins & Evermann 280. * ‡
241. Doryrhamphus californiensis Gill. †
242. Hippocampus ingens Girard 279. * ‡

Famly LXXVII.

FISTULARIIDÆ. The Cornet-Fishes.

243. Fistularia corneta Gilbert & Starks. ‡
244. Fistularia depressa Günther. ‡

Family LXXVIII.

MACRORHAMPHOSIDÆ.

245. Macrorhamphosus hawaiiensis Gilbert 154.

Family LXXIX.

ATHERINIDÆ. The Silversides.

246. Menidia clara Evermann & Jenkins. ‡
247. Leuresthes tenuis crameri Jordan & Evermann. *
248. Leuresthes tenuis Ayres 20.
249. Atherinopsis californiensis californiensis Girard 19.
250. Atherinopsis californiensis sonoræ Osburn & Nichols. *
251. Atherinops affinis insularum Gilbert 18.
252. Atherinops affinis cedroscensis Hubbs. SC. *
253. Atherinops affinis littoralis Hubbs 17.
254. Atherinops affinis guadalupæ Hubbs. *
255. Colpichthys regis Jordan & Evermann. ‡
256. Eurystole eriarcha Jordan & Gilbert. † ‡

Family LXXX.

MUGILIDÆ. The Mullets.

257. Mugil cephalus Linnæus 162.
258. Mugil curema Cuvier & Valenciennes. † ‡
259. Chænomugil proboscideus Günther. †
260. Agonostomus nasutus Günther.. * Fr. 207.

Family LXXXI.

SPHYRÆNIDÆ. The Barracudas.

261. Sphyræna ensis Jordan & Gilbert. ‡
262. Sphyræna argentea Girard 275. *

Family LXXXII.

POLYNEMIDÆ. The Thread-fins.

263. Polynemus approximans Lay & Bennett 201. ‡

Family LXXXIII.

SCOMBRIDÆ. The Mackerels.

264. Pneumatophorus diego Ayres 222.

Family LXXXIV.

CYBIIDÆ.

265. Scomberomorus sierra Jordan & Starks 224. ‡
266. Sarda chilensis Cuvier & Valenciennes 223.

Family LXXXV.

THUNNIDÆ. The Tunnies: Albacores.

267. Thunnus thynnus Linnæus 225. *
268. Germo alalunga Gmelin 218. *
269. Parathunnus sibi Temminck & Schlegel 221.
270. Neothunnus macropterus Temminck & Schlegel 220.
Neothunnus catalinæ Jordan & Evermann.
271. Thunnus saliens Jordan & Evermann.

Family LXXXVI.

KATSUWONIDÆ.

272. Katsuwonus pelamis Linnæus 219.
273. Auxis thazard Lacépède 217.

Family LXXXVII.

TRICHIURIDÆ. The Hair-tails.

274. Trichiurus lepturus Linnæus 290.
275. Lepidopus xantusi Goode & Bean 144. †

Family LXXXVIII.

ISTIOPHORIDÆ The Sail-Fishes; Spear-Fishes.

276. Makaira mitsukurii Jordan & Snyder 127.
277. Makaira holei Jordan & Evermann.
278. Makaira marlina Jordan & Hill.

Family LXXXIX.

XIPHIIDÆ. The Sword-Fishes.

279. Xiphias gladius Linnæus 291.

Family XC.

LUVARIDÆ.

280. Luvarus imperialis Rafinesque 152.

Family XCI.

CORYPHÆNIDÆ The Dolphins; Dorados.

281. Coryphæna hippurus Linnæus 58.

Family XCII.

BRAMIDÆ. The Sea Breams.

282. Brama raii Bloch 45.

Family XCIII.

STROMATEIDÆ.

283. Palometa simillimus Ayres 277.

Family XCIV.

TETRAGONURIDÆ.

284. Tetragonurus cuvieri Risso 287.

Family XCV.
CENTROLOPHIDÆ.
285. Schedophilus heathii Gilbert 135.

Family XCVI.
ACROTIDÆ.
286. Acrotus willoughbyi Bean 1.

Family XCVII.
CARANGIDÆ. The Cavallas.
287. Oligoplites saurus Bloch & Schneider. ‡
288. Oligoplites mundus Jordan & Starks. ‡
289. Naucrates ductor Linnæus 49. *
290. Seriola dorsalis Gill 50. * ‡
291. Seriola colburni Evermann & Clark. ‡
292. Decapterus hypodus Gill. †
293. Trachurus symmetricus Ayres 51. *
294. Trachurus trachurus Linnæus. †
295. Trachurops crumenophthalma Bloch. † ‡
296. Caranx vinctus Jordan & Gilbert. ‡
297. Caranx hippos Linnæus. ‡
298. Caranx caballus Günther. * †
299. Gnathanodon speciosus Forskål. † ‡
300. Citula dorsalis Gill. ‡
301. Vomer setipinnis Mitchell. †
302. Selene vomer Linnæus. * ‡
303. Chloroscombrus orqueta Jordan & Gilbert. *
304. Trachinotus rhodopus Gill. * †
305. Trachinotus kennedyi Steindachner. *
306. Trachinotus paloma Jordan & Starks. * †

Family XCVIII.
NEMATISTIIDÆ. The Peacock-Fishes.
307. Nematistius pectoralis Gill. ‡

Family XCIX.
APOGONIDÆ. The Cardinal-Fishes.
308. Apogon retrosella Gill. †
309. Apogon guadalupensis Osburn & Nichols. *

Family C.
CENTROPOMIDÆ. The Robalos.
310, Centropomus viridis Lockington.

Family CI.
MORONIDÆ. The White Bass.
311. Roccus saxatilis Walbaum. SC.

Family CII.
EPINEPHELIDÆ. The Sea Bass; Groupers; Garrupas.
312. Petrometopon panamensis Steindachner. ‡
313. Stereolepis gigas Ayres 273.
314. Bodianus acanthistius Gilbert. ‡
315. Epinephelus labriformis Jenyns. †
316. Epinephelus niphobles Gilbert & Starks. *
317. Promicrops guttata Linnæus. ‡
318. Dermatolepis punctatus Gill. † ‡
319. Mycteroperca jordani Jenkins & Evermann. ‡
320. Mycteroperca pardalis Gilbert. ‡
321. Mycteroperca rosacea Streets. ‡
322. Mycteroperca venadorum Jordan & Starks. ‡
323. Rypticus xanti Gill. †
324. Rypticus nigripinnis Gill. †

Family CIII.
SERRANIDÆ. The Sea Bass.
325. Paralabrax nebulifer Girard 272. *
326. Paralabrax maculatofasciatus Steindachner 271. ‡
327. Paralabrax clathratus Girard 270. *
328. Diplectrum radiale Quoy & Gaimard. * ‡
329. Diplectrum sciurus Gilbert. * ‡
330. Prionodes æquidens Gilbert. ‡
331. Prionodes fasciatus Jenyns. †
332. Paranthias furcifer Cuvier & Valenciennes. †
333. Hemianthias peruanus Steindachner. *
334. Pronotogrammus multifasciatus Gill. †

Family CIV.
HOPLOPAGRIDÆ.
335. Hoplopagrus güntheri Gill. ‡

Family CV.
LUTIANIDÆ. The Snappers.
336. Lutianus novemfasciatus Gill. ‡
337. Lutianus argentiventris Peters. ‡
338. Lutianus colorado Jordan & Gilbert. ‡
339. Lutianus guttatus Steindachner. ‡

Family CVI.
XENICHTHYIDÆ.
340. Xenistius californiensis Steindachner 151. *
341. Xenichthys xanti Gill. †

Family CVII.
JORDANICHTHYIDÆ.
342. Jordanichthys holei Evermann & Clark. ‡

CVIII.
HÆMULIDÆ. The Pomadasidæ; Grunts.
343. Hæmulon sexfasciatum Gill. ‡
344. Hæmulon scudderi Gill. ‡
345. Hæmulon steindachneri Jordan & Gilbert. ‡
346. Lythrulon flaviguttatum Gill. ‡
347. Orthostœchus maculicauda Gill. ‡
348. Anisotremus interruptus Gill. * ‡
349. Anisotremus davidsoni Steindachner 131. *
350. Anisotromus tæniatus Gill. *
351. Conodon serrifer Jordan & Gilbert. *
352. Brachydeuterus nitidus Steindachner. ‡
353. Brachydeuterus leuciscus Günther. † ‡
354. Brachydeuterus axillaris Steindachner. ‡
355. Orthopristis reddingi Jordan & Richardson. ‡
356. Orthopristis chalcius Günther. † ‡
357. Isaciella brevipinnis Steindachner. ‡
358. Microlepidotus inornatus Gill. ‡

Family CIX.
SPARIDÆ. The Pargos.
359. Calamus brachysomus Lockington. * ‡

Family CX.
GIRELLIDÆ.
360 Girella nigricans Ayres 138. *
361. Girella simplicidens Osburn & Nichols. ‡

Family CXI.

KYPHOSIDÆ. The Pilot Fishes.

362. Hermosilla azurea Jenkins & Evermann. * ‡
363. Hermosilla robusta Osburn & Nichols. ‡
364. Kyphosus analogus Gill. ‡
365. Kyphosus elegans Peters. ‡

Family CXII.

GERRIDÆ. The Mojarras; Silver Perch.

366. Eucinostomus californiensis Gill 114. * † ‡
367. Gerres cinereus Walbaum. * † ‡
368. Diapterus peruvianus Cuvier & Valenciennes. ‡
369. Diapterus lineatus Humboldt. ‡

Family CXIII.

MULLIDÆ. The Surmullets.

370. Mulloides rathbuni Evermann & Jenkins. ‡
371. Upeneus dentatus Gill. ‡
372. Upeneus xanthogrammus Gilbert. * ‡

Family CXIV.

SCIÆNIDÆ. The Croakers; Roncadores.

373. Ophioscion strabo Gilbert. ‡
374. Corvina saturna Girard 206.
375. Corvina thompsoni Hubbs 207.
376. Roncador stearnsi Steindachner 212.
377. Genyonemus lineatus Ayres 210. *
378. Micropogon megalops Girard. ‡
379. Umbrina roncador Jordan & Gilbert 214. * ‡
380. Umbrina xanti Gill. * † ‡
381. Umbrina dorsalis Gill. †
382. Menticirrhus undulatus Girard 211. * ‡
383. Equetus viola Gilbert. ‡

Family CXV.

OTOLITHIDÆ.

384. Seriphus politus Ayres 213. *
385. Cynoscion othonopterus Jordan & Gilbert. ‡
386. Cynoscion parvipinnis Ayres 209.
387. Cynoscion macdonaldi Gilbert. ‡
388. Atractoscion nobilis Ayres 208.

Family CXVI.

BRANCHIOSTEGIDÆ.

389. Caulolatilus princeps Jenyns 159. *

Family CXVII.

CIRRHITIDÆ.

390. Cirrhites rivulatus Valenciennes. †
391. Cirrhites betaurus Gill. †

Family CXVIII.

SCORPIDÆ. The Half-moon Fishes.

392. Medialuna californiensis Steindachner 139. *

Family CXIX.

EPHIPPIDÆ.

393. Chætodipterus zonatus Girard. SC. *

Family CXX.

CHÆTODONTIDÆ. The Butterfly Fishes; Coral Fishes.

394. Chætodon nigrirostris Gill. †
395. Chætodon humeralis Günther. ‡
396. Holacanthus passer Valenciennes. † ‡

Family CXXI.

ACANTHURIDÆ. TEUTHIDÆ.

397. Xesurus punctatus Gill. † ‡

Family CXXII.

SCORPÆNIDÆ. The Scorpion Fishes; Rock Cod.

398. Sebastolobus alascanus Bean 226. *
399. Sebastolobus altivelis Gilbert 227. * †
400. Sebastodes goodei Eigenmann & Eigenmann 244.
401. Sebastodes paucispinis Ayres 253.
402. Sebastodes flavidus Ayres 241.
403. Sebastodes serranoides Eigenmann & Eigenmann 265.
404. Sebastodes mystinus Jordan & Gilbert 251.
405. Sebastodes rufus Eigenmann and Eigenmann 261.
406. Sebastodes macdonaldi Eigenmann & Beeson 247.
407. Sebastodes ovalis Ayres 252.
408. Sebastodes alutus Gilbert 229.
409. Sebastodes proriger Jordan & Gilbert 255
410. Sebastodes pinniger Gill 254.
411. Sebastodes miniatus Jordan & Gilbert 250.
412. Sebastodes atrovirens Jordan & Gilbert 230.
413. Sebastodes saxicola Gilbert 263.
414. Sebastodes semicinctus Gilbert 264.
415. Sebastodes diploproa Gilbert 238.
416. Sebastodes aurora Gilbert 232.
417. Sebastodes melanostomus Eigenmann & Eigenmann 248.
418. Sebastodes introniger Gilbert 245.
419. Sebastodes ruberrimus Cramer 259.
420. Sebastodes constellatus Jordan & Gilbert 237.
421. Sebastodes umbrosus Jordan & Gilbert 267.
422. Sebastodes rosaceous Girard 258.
423. Sebastodes ayresii Gilbert & Cramer 233.
424. Sebastodes rhodochloris Jordan & Gilbert 257.
425. Sebastodes eos Eigenmann & Eigenmann 240.
426. Sebastodes gilli Eigenmann & Eigenmann 243.
427. Sebastodes chlorostictus Jordan & Gilbert 235.
428. Sebastodes rupestris Gilbert 262.
429. Sebastodes sinensis Gilbert. ‡
430. Sebastodes zacentrus Gilbert 269.
431. Sebastodes elongatus Ayres 239.
432. Sebastodes levis Eigenmann & Eigenmann 246.
433. Sebastodes rubrivinctus Jordan & Gilbert 260.
434. Sebastodes auriculatus Girard 231.
435. Sebastodes rastrelliger Jordan & Gilbert 256.
436. Sebastodes vexillaris Jordan & Gilbert 268.
437. Sebastodes carnatus Jordan & Gilbert 234.
438. Sebastodes chrysomelas Jordan & Gilbert 236.
439. Sebastodes serriceps Jordan & Gilbert 266.
440. Soorpænodes xyris Jordan & Gilbert. † ‡
441. Scorpæna guttata Girard 228. * ‡
442. Scorpæna mystes Jordan & Starks. ‡
443. Scorpæna sonoræ Jenkins & Evermann. * †
444. Pontinus sierra Gilbert. ‡

Family CXXIII.
ANOPLOPOMIDÆ. The Skil Fishes; Sable Fishes.

445. Anoplopoma fimbria Pallas 14.

Family CXXIV.
HEXAGRAMMIDÆ. The Greenlings.

446. Hexagrammos superciliosus Pallas 134.

Family CXXV.
OPHIODONTIDÆ. The Cultus Cods.

447. Ophiodon elongatus Girard 133.

Family CXXVI.
OXYLEBIIDÆ.

448. Oxylebius pictus Gill 180.

Family CXXVII.
ZANIOLEPIDÆ.

449. Xantocles frenatus Eigenmann 292.

Family CXXVIII.
COTTIDÆ.

450. Paricelinus hopliticus Eigenmann & Eigenmann 76.
451. Chitonotus pugetensis Steindachner 62.
452. Tarandichthys cavifrons Gilbert 82.
453. Tarandichthys filamentosis Gilbert 83.
454. Tarandichthys tenuis Gilbert 84.
455. Icelinus fimbriatus Gilbert 69.
456. Icelinus oculatus Gilbert. SC.
457. Icelinus quadriseriatus Lockington 71. *
458. Icelinus fuscescens Gilbert 70.
459. Astrolytes notospilotus Girard 59.
460. Paratedius hankinsoni Hubbs. SC.
461. Orthonopias triacis Starks & Mann 74a.
462. Ruscariops creaseri Hubbs 79.
463. Icelus australis Eigenmann & Eigenmann 72.
464. Radulinus boleoides Gilbert 78.
465. Radulinus asprellus Gilbert 77.
466. Calycilepidotus spinosus Ayres 61.
467. Aspicottus bison Girard 67.
468. Scorpænichthys marmoratus Ayres 81.
469. Cottus asper Richardson. SC. Fr.
470. Zesticelus profundorum Gilbert 85.
471. Leiocottus hirundo Girard 73.
472. Leptocottus armatus australis Hubbs 74.
473. Clinocottus analis analis Girard 64.
474. Clinocottus analis australis Hubbs 65.
475. Blennicottus globiceps Girard. SC.
476. Montereya recalva Greeley 60.
477. Dialarchus snyderi Greeley 66.
478. Greeleya rubellio Greeley 68.

Family CXXIX.
AGONIDÆ. The Sea-Poachers; Aligator-Fishes.

479. Averruncus sterletus Gilbert 4.
480. Averruncus emmelane Jordan & Starks 3.
481. Asterotheca pentacantha Gilbert 2.
482. Xeneretmus latifrons Gilbert 6.
483. Xeneretmus leiops Gilbert 7.
484. Xeneretmus ritteri Gilbert 8.
485. Xeneretmus triacanthus Gilbert 9.
486. Odontopyxis trispinosus Lockington 5.

Family CXXX.
LIPARIDÆ. The Sea-Snails.

487. Neoliparis mucosus Ayres 148.
488. Careproctus melanurus Gilbert 145.
489. Paraliparis cephalus Gilbert 149.
490. Paraliparis rosaceus Gilbert. SC.
491. Liparisicus nanus Gilbert 146.

Family CXXXI.
TRIGLIDÆ.

492. Prionotus gymnostethus Gilbert. SC. ‡
493. Prionotus stephanophrys Lockington. ‡
494. Prionotus albirostris Jordan & Bollman. ‡
495. Prionotus horrens Richardson. *

Family CXXXII.
EMBIOTOCIDÆ.

496. Amphigonopterus aurora Jordan & Gilbert 91.
497. Micrometrus minimus Gibbons 101. *
498. Cymatogaster aggregatus Gibbons 93. *
499. Brachyistius frenatus Gill 92. *
500. Zalembius rosaceus Jordan & Gilbert 106.
501. Hypocritichthys analis A. Agassiz 99.
502. Hyperprosopon argenteus Gibbons 98.
503. Tocichthys ellipticus Gibbons.
504. Crossochir koelzi Hubbs. SC.
505. Amphistichus argenteus Agassiz 90.
506. Embiotoca jacksoni Agassiz 95. *
507. Tæniotoca lateralis Agassiz 105.
508. Phanerodon furcatus Girard 103.
509. Phanerodon atripes Jordan & Gilbert 102.
510. Rhacochilus toxotes Agassiz 104.
511. Hypsurus caryi Agassiz 100.
512. Damalichthys vacca Girard 94.

Family CXXXIII.
POMACENTRIDÆ.

513. Ayresia punctipinnis Cooper 203. *
514. Chromis atrilobatus Gill. † ‡
515. Pomacentrus rectifrenum Gill. † ‡
516. Pomacentrus flavilatus Gill. †
517. Abudefduf marginatus Bloch. ‡
518. Hypsypops rubicundus Girard 204. *
519. Microspathadon bairdii Gill. †
520. Microspathadon dorsalis Gill. †

Family CXXXIV.
LABRIDÆ.

521. Harpe diplotenia Gill. † ‡
522. Pimelometopon pulcher Ayres 142. * † ‡

Family CXXXV.
CORIDÆ.

523. Halichœres semicinctus Ayres 140. * ‡
524. Halichœres dispilus Günther. ‡
525. Oxyjulis californica Günther 141. *
526. Emmeekia venusta Jenkins & Evermann. * ‡
527. Pseudojulis melanotus Gilbert. ‡
528. Chlorichthys leucosanus Gill. †
529. Xyrichthys mundiceps Gill. †
530. Iniistius mundicorpus Gill. †

Family CXXXVI.
SCARIDÆ.

531. Scarus perrico Jordan & Gilbert. ‡
532. Scarus microps Osburn & Nichols. ‡
533. Scarus noyesi Heller & Snodgrass. ‡
534. Scarus compressus Osburn & Nichols. ‡

Family CXXXVII.
ELEOTRIDÆ. The Sleepers.

535. Philypnus lateralis Gill. †
536. Dormitator latifrons Richardson. † ‡
537. Eleotris pictus Kner & Steindachner. †
538. Alexurus armiger Jordan & Richardson. *
539. Chriolepis minutillus Gilbert. *

Family CXXXVIII.
GOBIIDÆ. The Gobies.

540. Bathygobius soporator Cuvier & Valenciennes. ‡
541. Rhinogobiops nicholsii Bean 128.
542. Zonogobius zebra Gilbert 130.
543. Gobionellus sagittula Günther 123. ‡
544. Lythrypnus dalli Gilbert 126.
545. Awaous taiasica Lichtenstein. * †
546. Bollmannia ocellata Gilbert. ‡
547. Bollmannia macropoma Gilbert. ‡
548. Bollmannia stigmatura Gilbert. ‡
549. Aboma chiquita Jenkins & Evermann. ‡
550. Zalypnus cyclolepis Gilbert. ‡
551. Zalypnus emblamaticus Jordan & Gilbert. ‡
552. Eucyclogobius newberryi Girard 120.
553. Lepidogobius lepidus Girard 125.
554. Gillichthys mirabilis Cooper 122.
555. Gillichthys detrusus Gilbert & Scofield. ‡
556. Quietula y-cauda Jenkins & Evermann 127.
557. Ilypnus gilberti Eigenmann & Eigenmann 124.
558. Clevelandia ios Jordan & Gilbert 119.
559. Gobiosoma histrio Jordan. ‡
560. Gobiosoma crescentale Gilbert. * ‡
561. Evermannia longipinnis Steindachner 121.
562. Typhlogobius californiensis Steindachner 129.
563. Lethops connectens Hubbs 125a.

Family CXXXIX.
GOBIOIDIDÆ.

564. Tyntlastes sagitta Günther 289a. *

Family CXL.
ECHENEIDÆ. The Remoras; Shark-Pilots.

565. Echeneis naucrates Linnæus 88.
566. Remora remora Linnæus 89.
567 Remorina albescens Temminck & Schlegel 291a. ‡

Family CXLI.
BATHYMASTERIDÆ. The Ronquils.

568. Rathbunella hypoplecta Gilbert 24.

Family CXLII.
OPISTHOGNATHIDÆ. The Jaw-Fishes.

569. Opisthognathus ommatus Jenkins & Evermann. ‡
570. Gnathypops scops Jenkins & Evermann. ‡
571. Gnathypops rhomalea Jordan & Gilbert. ‡
572. Gnathypops snyderi Jordan & Evermann. ‡

CXLIII.
URANOSCOPIDÆ. The Star-gazers.

573. Astroscopus zephyreus Gilbert & Starks. *

Family CXLIV.
DACTYLOSCOPIDÆ.

574. Gillellus semicinctus Gilbert. ‡
575. Gillellus arenicola Gilbert. †
576. Gillellus ornatus Gilbert. ‡
577. Dactyloscopus pectoralis Gill. †
578. Dactyloscopus lunaticus Gilbert. † ‡
579. Dactyloscopus cinctus Osburn & Nichols. †
580. Dactylagnus mundus Gilbert. * ‡
581. Myxodagnus opercularis Gill. †

Family CXLV.
CLINIDÆ. The Scaly Blennies.

582. Heterostichus rostratus Girard 35.
583. Gibbonsia metzi Hubbs 34. *
584. Gibbonsia elegans elegans Cooper 33. *
585. Neoclinus blanchardi Girard 38.
586. Pterognathus satiricus Girard 41.
587. Malacoctenus delalandi Cuvier & Valenciennes. *
588. Labrisomus xanti Gill. * † ‡
589. Alloclinus holderi Lauderbach 42.
590. Starksia cremnobates Gilbert.
591. Cryptotrema corallinum Gilbert 32.
592. Exerpes asper Jenkins & Evermann. ‡
593. Cremnobates ativelis Lockington. ‡
594. Cremnobates monophthalmus Günther. ‡
595. Cremnobates integripinnis Rosa Smith 30. SC. *

Family CXLVI.
BLENNIIDÆ. The Naked Blennies.

596. Hypsoblennius gilberti Jordan 37.
597. Hypsoblennius gentilis Girard 36. * ‡
598. Chasmodes jenkinsi Jordan & Evermann. ‡
599. Runula azalea Jordan & Bollman. †
600. Atopoclinus ringens Vaillant ‡ Young of Runula?

Family CXLIII.
EMBLEMARIIDÆ.

601. Emblemaria oculocirris Jordan. ‡

Family CXLVIII.
CHÆNOPSIDÆ.

602. Chænopsis alepidota Gilbert 31. † ‡
603. Chænopsis lucius Osburn & Nichols. ‡
604. Pholidichthys anguilliformis Lockington. ‡
605. Psednoblennius hypacanthus Jenkins & Evermann. ‡

Family CXLIX.
CEBIDICHTHYIDÆ.

606. Cebidichthys violaceus Ayres 30a. SC.

Family CL.
PHOLIDÆ

607. Apodichthys flavidus Girard. SC.
608. Xererpes fucorum Jordan & Gilbert 44.
609. Ulvicola sanctæ-rosæ Gilbert & Starks 43. *

Family CLI.
STICHÆIDÆ.

610. Plectobranchus evides Gilbert 39.
611. Poroclinus rothrocki Bean 40.

Family CLII.
ANARRHICHTHYIDÆ.

612. Anarrhichthys ocellatus Ayres 13.

Family CLIII.
ZOARCIDÆ.

613. Embryx crassilabris Gilbert 295.
614. Embryx crotalinus Gilbert SC.
615. Lycodopsis pacificus Collett 297.
616. Aprodon cortezianus Gilbert 293.
617. Lychenchelys porifer Gilbert. *
618. Furcimanus diapterus Gilbert 296.
619. Lyconema barbatum Gilbert 301.
620. Bothrocara remigera Gilbert 294.
621. Melanostigma pammelas Gilbert 300.
622. Maynea californica Gilbert 299.
623. Lycogramma brunnea Bean 298.

Family CLIV.
LYCODAPODIDÆ.

624. Lycodapus fierasfer Gilbert 153.

Family CLV.
BROTULIDÆ.

625. Catætyx rubrirostris Gilbert 47.
626. Brosmophysis marginatus Ayres 46.
627. Ogilbia ventralis Gill. ‡
628. Mœbia promelas Gilbert. * ‡
629. Bassogigas stelliferoides Gilbert. *

Family CLVI.
OPHIDIIDÆ.

630. Lepophidium emmelas Gilbert. *
631. Lepophidium stigmatistium Gilbert. *
632. Lepophidium pardale Gilbert. *
633. Lepophidium microlepis Gilbert. ‡
634. Otophidium galeoides Gilbert. ‡
635. Otophidium taylori Girard 179.
636. Otophidium scrippsi Hubbs 179a. *

Family CLVII.
BATRACHOIDIDÆ.

637. Porichthys notatus Girard 25. *

Family CLVIII.
GOBIESOCIDÆ.

638. Bryssetæres pinniger Gilbert. ‡
639. Gobiesox adustus Jordan & Gilbert. ‡
640. Gobiesox funebris Gilbert. ‡
641. Gobiesox papillifer Gilbert 116. *
642. Rimicola eigenmanni Gilbert 117.
643. Arbaciosa rhessodon Smith 115.
644. Arbaciosa humeralis Gilbert.
645. Arbaciosa eos Jordan & Gilbert. ‡

Family CLIX.
BALISTIDÆ.

646. Verrunculus polylepis Steindachner. * ‡
647. Sufflamen capistratum Shaw. ‡
648. Xanthichthys mento Jordan & Gilbert. SC.

Family CLX.
TETRAODONTIDÆ.

649. Spheroides politus Girard 288. * ‡
650. Spheroides lobatus Steindachner. † ‡
651. Ovoides setosus R. Smith. † ‡

Family CLXI.
CANTHIGASTERIDÆ Sharp-nosed Puffers.

652. Canthigaster punctatissimus Günther. ‡

Family CLXII.
DIODONTIDÆ.

653. Diodon hystrix Linnæus 87. † ‡
654. Diodon holacanthus Linnæus. *
655. Chilomycterus affinis Günther 86.

Family CLXIII.
MOLIDÆ.

656. Mola mola Linnæus 161.

Family CLXIV.
ANTENNARIIDÆ.

657. Antennarius avalonis Jordan & Starks 15.
658. Antennarius reticularis Gilbert. ‡
659. Antennarius sanguineus Gill. †

Family CLXV.
OGCOCEPHALIDÆ.

660. Malthopsis erinacea Garman. *
661. Dibranchus hystrix Garman. †

Family CLXVI.
CERATIIDÆ.

662. Monoceratias acanthias Gilbert 52.

The Discovery of a Remarkable Type of Mud-Minnow in Western Washington

By Leonard P. Schultz, College of Fisheries
University of Washington, Seattle

Dr. Theodore Gill wrote in 1902, "The umbrids or mud-minnows are a feeble family represented by a single genus whose species are distributed in a notable manner. A single one, *Umbra garmeri,* occurs in central and southeastern Europe, Hungary, and neighboring countries, and two others are inhabitants of the eastern slope of the American continent and Mississippi valley, while all the intervening countries are deprived of them."

"It is really remarkable that, with such adaptability and such power of endurance as they possess, the range of the genus should be now so restricted. Restricted it undoubtedly is, for the European and American species must be relics of a once widely dispersed group."

However, in 1921 Mr. John H. Winslow, Game Warden of Grays Harbor County, Washington, sent the College of Fisheries, University of Washington, a number of specimens of a fish (all less than 37 mm. in length), found in a drainage ditch near Satsop, one mile north of the Chehalis River in the same county. Through some mishap these specimens were mislaid until late in 1928 when they were carefully studied by the author and found to be a type of mud-minnow.

A thorough search of the region between Elma and Satsop, Washington, was made on February 24, 1929, by the writer in an attempt to locate living specimens of this new fish. After three hours of intensive work eleven specimens, (all adults), two females and nine males in breeding colors, between 55 and 70 mm. in length were collected from the type locality, a drainage ditch about a mile east of Satsop. The fishes of the 1921 collection were made the type of a new species, new genus, and family in a paper published at the University of Washington.[1]

The new fish, *Novumbra hubbsi* Schultz, may be identified by the paired proethmoids, and the simple coracoid, apparently undivided by a suture into hyper-hypocoracoid. There are four pectoral radials, to which the 18 to 23 pectoral fin rays are attached. This fin is pedunculate and asymmetrical, the lowermost rays are almost rudimentary. The dorsal fin of 12 to 15 rays, and the anal of 11 to 13 rays are about the same length. The origin of the dorsal is inserted only a trifle in advance of the anal. The ventral fin has 7 rays (occasionally 6), and is inserted a little in advance of the dorsal, the rays reaching a little past the origin of the anal fin. There are 7 branchiostegals. The cycloid scales are in about 52 to 58 rows along the side of the body, all of which show radii. The teeth occur on the premaxillaries, palatines, vomers, dentaries and tongue.

The color of these fishes is very similar to that found on young pike, as well as on the mud-minnow, *Umbra limi* of the middlewestern United States. The black bar on the caudal fin of *Umbra limi* is lacking in this species. The breeding colors of the males and females of *Novumbra hubbsi,* the Washington mud-minnow, are beautiful, not unlike some of the highly colored darters of the eastern North America. The following description was made from specimens of the February 24 collection as they were taken from the water:

The females resemble the males closely but are duller. The ground color pat-

(1) The Description of a new type of mud-minnow from Southwestern Washington, with notes on related species. By Leonard P. Schultz, University of Washington Publications in Fisheries. Vol. II, No. 5, 1929.

tern of the male is of black vertical bars, with alternating narrow bright areas of pea green, (this color changed to silvery yellow and greenish irridescence when placed in an aquarium). The black faded to a chocolate brown very soon after removing from the water. The anal and dorsal fins are colored similarly by two or three blackish broken bars or blotches, rather irregular except the outer which is very black and followed at the edge of the fin by a narrow beautiful light grass green margin, highly contrasted with the black below it. This edge changed to an electric blue in different lights. The pectoral fins are very dark, almost black as are the ventrals and the caudal, their color is due to pigment on the membranes between the fin rays which is intensified near the margins. The bases of these fins are marked with dull ochre. The side of the body had numerous very narrow longitudinal faint streaks as is found on *Umbra limi* when the males are spawning. Through the eye is a vertical black bar, slightly narrower than the pupil, but obsolete in preserved specimens. From the back of the eye to the top of the operculum extends a brownish band, below which are two shorter obsolete irregular hands or blotches. The tip of the operculum has a black bar, the lower half of which is emerald green (but changed to a peacock green in the aquarium). This bar on the opercular flap continued as a bluish black band on the branchiostegal membranes grading into emerald green antehiorly. The branchiostegals themselves were dull yellowish orange. The operculum is irridescent brassy gold between the dusky horizontal blotches. The tip of the jaws is dark colored. The region anterior to the dorsal fin on the back is uniformly colored dark or dark brown. The belly is dusky and unspotted.

The discovery of this mud-minnow stimulated a review of other related species, which has resulted in a major change in the classification of the Alaskan blackfish. This change is based on the differences found between the pectoral girdles of the three genera under discussion.

Novumbra hubbsi has a cleithrum (clavivle) fully ossified which overlaps and partly conceals the coracoidal element fused directly to the cleithrum by sutures throughout its greater length, except for a small foramen in the hypocoracoid. The radials (I find four in each of four dissections), are smaller than the coracoid, and these coupled with the great elongation of the coracoid element give the pectoral fin its pedunculate appearance. The coracoids are perforated by the coracoidal foramen, which does not join a larger opening next to the cleithrum as sometimes found in *Umbra limi.* Only one center of ossification can be found in the coracoid, though the entire pectoral girdle is a hard type of bone.

Umbra limi shows more differentiation than the new mud-minnow or *Dallia pectoralis,* the Alaskan blackfish. The cleithrum of *Umbra limi* is a large ossified bone partly covering the hypercoracoid and the hypocoracoid which are well separated by a suture and a large perforation. They are joined to the cleithrum at each end but not in the middle because the whole central portion is cut out by a triangular emargination. This same emargination is present in *Novumbra hubbsi* but is very small. All of the coracoid is fairly well ossified. The number of radials is either three or four, considerable variation apparently occurs.

The pectoral girdle of *Dallia pectoralis* is represented by an ossified cleithrum which partly overlaps a cartilaginous plate, the coracoid, overlooked by Gilbert (Jordan and Evermann, Fishes of North and Middle America, Part 1, 1896, p. 620 footnote). This coracoid is attached to the cleithrum by sutures at its base. Distally the coracoid is expanded and joins the two greatly enlarged radials (actinosts) previously interpreted as coracoids to which the fins rays are directly attached. My dissections show no perforations

of the coracoid, but Dr. Carl L. Hubbs, University of Michigan, who was informed about the presence of the coracoid in this fish, checked my observations by two dissections in which he found a perforation of the coracoid of one girdle, which was entirely lacking in both of my specimens. Evidently there is considerable variation in the coracoidal element of *Dallia pectoralis*. The two radials were separated mesially and fused at their distal ends. The pedunculate appearance of the pectoral fin is due to the enlarged radials, instead of the combined coracoids and radials as in *Novumbra hubbsi*.

It becomes very evident after carefully studying the coracoid elements, as well as the pectoral radials in the three typical species, that they possess homologous structures which are anatomically very similar in shape and sizes. There is a degeneracy, or perhaps less specialization, at least a decrease in the size of the coracoid elements through *Umbra limi, Novumbra hubbsi,* to *Dallia pectoralis,* and an increase in size of the pectoral radials in the same order through the three species. These facts among others clearly indicate the intermediate position of the new species, between that of Dallia and Umbra. Dr. Gilbert and Dr. Gill who overlooked the coracoid (which is easily understood from its small size (in *Dallia pectoralis,* naturally misinterpreted the pectoral radials, and placed Dallia in the order Xenomi. It is very obvious after the present analysis that *Dallia pectoralis* belongs to the Order Haplomi, along with the mud-minnows and the pikes, its nearest relatives. The Xenomi can no longer be recognized as a distinct order, and must be placed as a synonym of Haplomi.

The new family Novumbridae may be distinguished from the Umbridae by the presence of the following characters: Caudal fins slightly concave in most specimens; scales with radii; lower jaw projecting; teeth on vomer, palatines, premaxillaries and the lower jaw and tongue. The origin of the anal fin has its insertion far back on the body, almost directly below the beginning of the dorsal fin. The ventrals are inserted farther forward than in the Umbras. There are a greater number of fin rays in all the fins, and about 55 rows of scales on the side of the body.

The Dalliidae is easily recognized from the Novumbridae by the rounded caudal fin, the greater number of pectoral rays (about 36), and only three rays in the ventral fins. There is a greater number of scale rows (about 77) on the side of the body. The pectoral girdle which was discussed in detail is one of the best characters by which the Novumbridae and Umbridae are separated from the Dalliidae.

My observations on the specimens gathered February 24 indicate the selection of a very restricted habitat, because none of the fish were found in the creeks of the region, all of which are characterized by a moderate to rapid current with sand or gravel bottoms and mud with weeds in the eddies. The eleven specimens were taken from a drainage ditch filled with about two or three feet of clear quiet water. The bottom was composed of about three inches of mud, dead vegetation, with living water, celery and considerable algae to a height of four inches. A careful examination of the ditch prior to fishing indicated their absence, but by seining and stirring the bottom with my boots, eleven fish were slowly found one at a time. It is not known how these fish became established in this ditch or the extent of their present range. Mr. Winslow in a letter dated March 14, 1929, found this new species in the Murray sloughs east of Elma during the low water of summer in 1926. He states they have never been found directly in the Chehalis River or any of the creeks.

The specimens which were collected by the writer were brought alive to the College of Fisheries and placed in a large aquarium and carefully observed. The

habits of the new mud-minnow are much like those of *Umbra limi* and those described for *Umbra krameri* of Europe. If frightened the fish often hides in the debris on the bottom and escapes observation. They dart at times from their place of seclusion to the surface or among the weeds, coming to rest on a stem or leaf, or are suspended obliquely in the water. It is not uncommon to find them upright resting on their tail. Very seldom are they found to be in a horizontal position. A characteristic pose is one in which the caudal region and tail fin are curved to one side, while the pectoral fins and the margins of the dorsal and anal fins wave rapidly. At other times one pectoral fin will wave rapidly while the other is motionless. The fish spends considerable time at the surface gulping air and quickly ejecting it, so that numerous bubbles remain in the vicinity.

Novumbra hubbsi is very excitable, sudden movements by the observer cause them to dart with great speed, often jumping clear of the water. It usually hides on the bottom after such behavior, lying motionless, often on its side for many minutes. The new mud-minnow is a sluggish fish except for these sudden bursts of great speed. It eats live food and has not been induced to take prepared foods. Small earthworms are cut up and dropped into the aquarium near the fish which swallows them whole. If the worms do not move the fish refuse to eat them. One fish out of the three now living, has not been induced to eat, though the other two eat greedily. There is no question but this new species will make a very desirable aquarium fish, because of its beautiful colors and interesting habits.

The occurrence of a mud-minnow in western Washington is unique, as well as very important, both from a biological and geological standpoint. Presumably this fish is a representative of the ancient fauna which extended across the North American Continent prior to the elevation of the Rockies. Fossil remains of this fauna are found in the Eocene Green River Shales of Wyoming. Two other living faunal relics, probably of this same ancient distribution have been found on the west coast of North America; they are *Columbia transmontana* Eigenmann and Eigenmann, a percopsid, and *Archoplites interruptus* Girard, of the family Centrarchidae. It is likely that the mud-minnows and the Alaskan blackfish were more widely distributed in archaic times (as suggested by Dr. Gill), than the North American Fauna just cited, because living representatives occur in the continents of both old and new worlds. One species is found in central Europe, two in the eastern United States, and another in the Chehalis river valley of western Washington. The Alaskan blackfish, a closely related species, occurs in the Tundra of Alaska and Siberia. All of these species of fish are separated from each other by extensive barriers.

Presumably the reason why this mud-minnow should be found in such a restricted area in southwestern Washington, lies in the fact that it selects a restricted habitat of quiet, almost stagnant water, which when correlated with the topography and the past glaciation of the state, will undoubtedly help explain the presence of a mud-minnow on the west coast, a thousand miles or more from any known related species, and separated by salt water, high mountains, or semi-deserts.

Breetz (1911) and Landes (1913) studied the glaciation of western Washington and reported that during the last ice age, the great Vashon Glacier, at least 4000 feet deep over Seattle, poured down the Puget Sound plain from the north terminating in the moraines of the region just south of Tacoma and Olympia, northwestward to the area just north of Elma and Satsop, to Lake Cushman, Washington. As this glacier retreated it left a gravel outwash plain and the rough, hilly moraine containing numerous bog lakes and kettle holes, not drained. Dur-

ing the retreat of the Vashon Glacier a great freshwater inland sea covered the territory at the southern end of the glacier between the Cascades and Olympic Mountains. This great sea had its outlet by way of the Gate Pathway, near Gate, Washington, down the present Black River, a tributary of the Chehalis River, thence to the ocean.

The Washington mud-minnow probably evolved from a stock which gave rise to the Alaskan Blackfish (one of its near relatives) and occupied the land northward. During the glaciation of the Northwest it was possible for the fish to be forced before the glaciers, which originated in the mountains of British Columbia, and become deposited in its present location. This case may parallel the grayling, which, it is thought, was carried southward during the glacier periods, and deposited in Montana and Michigan where it is found today.

The topography, it is thought, has had a direct influence on the present range of *Novumbra hubbsi,* the Washington mud-minnow. There is no record that the Olympic peninsula was recently covered by sea. The land at the headwaters of the Chehalis River, known as the Bald and Black Hills, has been above the sea from Pliocene or before. During the Pleistocene, when the Vashon Glacier filled the Puget Sound plain, the Black and Bald Hills stopped its southward flow and remained above it. Terminal moraines were left northward and westward. A driftless area occurs south of these moraines from the headwaters of the Tilton River to Centralia, by the Gate Pathway, thence northwestward to Lake Cushman and westward to the ocean. The tributaries of the Chehalis River on the east and south arise in mountainous hills, sharply cut by raging mountain streams, which have rock bottoms, entirely unsuited to the mud-minnow. The glacier would exclude this fish from the region between the Olympic and Cascade Mountains covered by the ice. The tributaries of the Chehalis valley to the eastward and southward are not suitable habitats for this fish. This would cause the fish to be isolated in the driftless area of the Chehalis river valley and southward during the glacier period.

During the retreat of the glacier, the great freshwater lake at the southern end of the ice might furnish the means for an extension of range from the driftless area. After the lake disappeared the mud-minnow might again be able to make its way up the Black River to Black Lake and from there, during high water of spring, into the Puget Sound drainage. However, these Puget Sound streams are swift and not suitable habitats. Puget Sound would limit its range northward. The waters of the streams coming down off the terminal moraine (the Black River included) are swift throughout their courses and not well suited for *Novumbra hubbsi.* These conditions probably would cause the extension of range to occur slowly or not at all from the driftless area. Judging from the habitat requirements and the glaciation of western Washington, we might expect to find the mud-minnow in the driftless area of the Chehalis valley, the terminal moraine, and the country westward to the ocean, in which occur marshes, bog lakes, and kettle holes, all of which are excellent habitats. However, if the Washington mud-minnow had a wide range prior to the Vashon Glacier it may occur in other sections of western Washington, west of the Cascades, and perhaps in the sloughs of the lower Columbia River.

We may conclude that this mud-minnow is remarkable because of its structural relationship, habitat requirements, and restricted range as now known to occupy only southwestern Washington. Also the study of *Novumbra hubbsi* has resulted in a clearer interpretation of the pectoral girdle of *Dallia pectoralis* with considerable change in the classification of that species.